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April 25, 2005

REMARKS

Applicant has amended his claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicant has amended claim 1 to recite that the photoreactive compound generates an acid upon undergoing a reaction with light; and has further amended claim 1 to recite that the photosensitive resin composition is a positive photosensitive resin composition.

Additionally, Applicant is adding new claims 14-17 to the application. Claims 14 and 15, each dependent on claim 1, respectively recites that the heat-resistant polymer is substantially free of polymerizable carbon-to-carbon double bonds; and recites that the photoreactive compound generates the acid such that the acid formed increases the solubility in an alkaline aqueous solution of the portion of the resin composition exposed to the light. Claims 16 and 17, each also dependent on claim 1, respectively recites that the photoreactive compound is selected from a specified group of materials; and recites amount of photoreactive compound included in the composition relative to the amount of heat-resistant polymer.

In connection with amendments to previously considered claims, and in connection with these newly added claims, note, for example, the last paragraph on page 3; the second full paragraph on page 12; the paragraph bridging pages 13 and 14; and the paragraph bridging pages 16 and 17, of Applicant's specification.

The request by the Examiner to resubmit an English-language translation of claim 2 in Japanese Patent Document No. 54-109828, and English abstracts of Japanese Patent Document No. 11-109620 and No. 11-143070, set forth in Item III on page 2 of the Office Action mailed November 23, 2004, is noted. Item III is silent as to whether the Japanese patent documents themselves, submitted when filing the English

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abstracts and translation of claim 2, were received in the Office electronic file for the above-identified application. Enclosed herewith please find such English translation of claim 2 and such English abstracts, together with the respective Japanese patent documents. Also enclosed is a copy of the Form PTO-1449 submitted with the Information Disclosure Statement filed November 6, 2003, so that the Examiner can properly initial the Form, to indicate consideration by the Examiner of these references. Consideration of the references, and initialing of the Form enclosed herewith listing, inter alia, the submitted documents, are respectfully requested.

Applicant respectfully submits that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the reference applied by the Examiner in rejecting claims in the Office Action mailed November 23, 2004, that is, the teachings of Japanese Patent Document No. 2002-012665 (Kaneda, et al.), under the provisions of 35 USC 103.

It is respectfully submitted that this reference as applied by the Examiner would have neither taught nor would have suggested such a photosensitive resin composition, or process for forming a relief pattern using such composition, or electronic component formed using such composition or such process, as in the present claims, the composition having the heat-resistant polymer, photoreactive compound and solvent, and wherein the polymer is represented by the general formula (1) with the end groups (Z) representing cyclic compound groups free of reactive unsaturated bonds, wherein the photoreactive compound is one which generates an acid upon undergoing a reaction with light, and wherein the photosensitive resin composition is a positive photosensitive resin composition. See claim 1; note also claims 11-13.

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In addition, it is respectfully submitted that these references would have neither taught nor would have suggested the other aspects of the present invention as previously considered by the Examiner, as well as all aspects in the present claims in the application, including (but not limited to) wherein the heat-resistant polymer is substantially free of polymerizable carbon-to-carbon double bonds (see claim 14); and/or wherein the photoreactive compound generates the acid such that the acid formed increases the solubility in an alkaline aqueous solution of the portion of the resin composition exposed to the light (see claim 15); and/or the further definition of the heat-resistant polymer as in claims 2-10, including the weight average molecular weight thereof (see claim 10); and/or the further definition of the photoreactive compound as in claim 16; and/or amounts of the photoreactive compound relative to 100 parts by weight of the heat-resistant polymer, as in claim 17.

The present invention is directed to a photosensitive resin composition, and uses thereof, the composition having heat resistance, which composition can be applied to semiconductor devices and the like in forming a surface protecting layer or an interlayer dielectric film layer. In particular, the present invention is directed to such composition which has enhanced storage stability and good mechanical and electrical properties.

Recently, as insulating layers in the semiconductor industry, organic substances having excellent heat resistance, such as polyimide resins, have come to be used, as, for example, materials for interlayer dielectric film layers. Conventional photosensitive polyimides are mainly of the negative type, in which an organic solvent is used as a developer and the exposed portion is made insoluble.

In addition, recently there has been an increasing demand for development of photosensitive resins with an alkaline aqueous solution, in order to reduce cost of

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materials and protect the environment. Typically, these photosensitive resins include a naphthoquinonediazide compound as a photosensitive agent and a polybenzoxazole precursor having an acid functional group as a base resin. Furthermore, in order to avoid problems during the curing process, introduction of a crosslinkable group having a carbon-to-carbon double bond into the terminals of the polymer has been proposed. In addition, molecular weight of the polymer is set at a relatively small level, to increase solubility. However, such polymer having decreased molecule weight cannot exhibit satisfactory mechanical properties even when cured, and thus lacks favorable properties as the resin. Moreover, where the polymer has a carbon-to-carbon double bond, polymerization can occur through a dark reaction, and, accordingly, the resin changes in viscosity with time, thereby lowering storage stability. Thus, it is difficult to maintain initial properties, such as resin and application properties, and photosensitive properties.

Against this background, Applicant provides a resin composition, and use thereof, wherein the composition can form a cured resin having desired properties without impairing development properties, and also has enhanced storage stability. Applicant has found that by utilizing, in the photosensitive composition, having the solvent, the heat-resistant polymer represented by the general formula (1) having the end groups (Z) which are cyclic compound groups free of reactive unsaturated bonds, together with a photoreactive compound which generates an acid upon undergoing a reaction with light, the composition being a positive photosensitive resin composition, improved storage stability is achieved while maintaining development properties. Such storage stability is particularly enhanced where the heat-resistant polymer is substantially free of polymerizable carbon-to-carbon double bonds. See, for example,

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the paragraph bridging pages 5 and 6 of Applicant's specification, as well as the paragraph bridging pages 27 and 28 thereof.

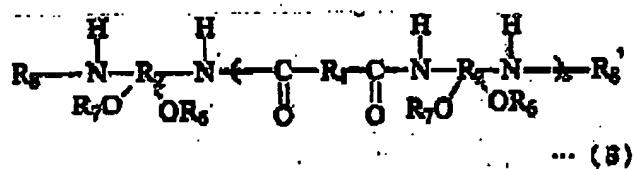
Kaneda, et al. discloses a photosensitive polybenzoxazole precursor resin and use thereof in forming a passivation film of insulating material for forming semiconductor devices, as well as an interlayer insulation film thereof. This patent document discloses that the photosensitive polybenzoxazole precursor resin has a univalent organic radical in which R₈ and R_{8'} have partial saturation expressed by the general formula (4) on page 5 of 24. This patent document further discloses that a negative-mold photopolymer constituent characterized by containing the photosensitive polybenzoxazole also includes a photopolymerization initiator, an intermolecular crosslinking agent that has a partial saturation double bond, and a dilution solvent.

Initially, it is respectfully submitted that the applied Japanese patent document discloses a negative photosensitive resin composition. Such disclosure would have neither taught nor would have suggested, and in fact would have taught away from, the presently claimed composition, which is a positive photosensitive resin composition.

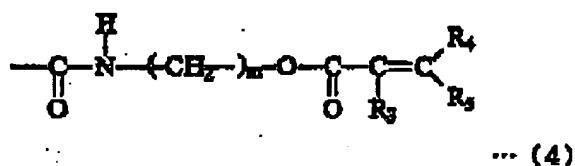
The Examiner relies on the machine English translation of "CLAIM" (3 pages), "DETAILED DESCRIPTION" (24 pages) and pages 79-83 of the Search Report from the Scientific and Technical Information Center of the U. S. Patent and Trademark Office, each with respect to Kaneda, et al., and contend that these describe a composition including a photosensitive compound, a solvent and a compound "being read within" the general formula (1) of the present claims. Such contention by the Examiner is respectfully traversed, particularly with respect to the claims as presently amended. It is respectfully submitted that Kaneda, et al. discloses a photosensitive polybenzoxazole

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precursor resin. Claim 3 of Kaneda, et al. refers to the following compound (5):

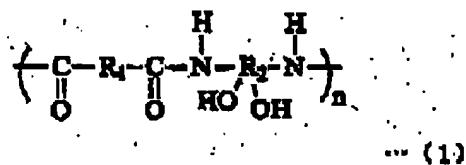


and also states the R₁, R₂, R₆ and R₇ are the same as those in the formula (5) in claim 2 of Kaneda, et al. Claim 2 of Kaneda, et al. states that at least 10 mole % of R₆ and R₇ is the organic residue represented by the following formula (4):



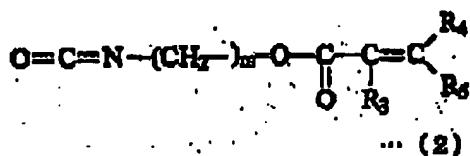
Thus, it is respectfully submitted that compound (5) in the composition of Kaneda, et al. must include the group (4). However, note that this group (4) has a carbon-to-carbon double bond, and it is respectfully submitted that this would not have the advantages of the present invention, especially with respect to storage stability.

The compound on pages 79-83 of the aforementioned Search Report is an example of polymer (1) in claim 1 of Kaneda, et al., as follows:



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However, what is claimed as the photosensitive resin in claim 1 of Kaneda, et al. is a reaction product of the polymer (1) with another compound represented by the formula (2) as follows:



which gives the group (4) above. Thus, it is respectfully submitted that Kaneda, et al. discloses the polymer (1) merely as a component of the photosensitive resin molecule (not as the resin itself). It is respectfully submitted that Kaneda, et al. as a whole would have neither taught nor would have suggested such composition as in the present claims, including the heat-resistant polymer thereof.

Moreover, it is respectfully submitted that the composition containing the aforementioned compound disclosed in Kaneda, et al., together with a photopolymerization initiator and a crosslinking agent, is a negative photopolymerization composition, as discussed previously. That is, upon light-irradiation of the composition of Kaneda, et al., the double bond of the group (4) cross-links to decrease solubility of exposed portions in the development solution. In contrast, the composition of the present invention is a positive photosensitive composition. That is, light-irradiation to the present composition will increase solubility of exposed portions in the development solution, as a result of generation of an acid. It is respectfully submitted that Kaneda, et al. would have neither taught nor would have suggested the composition, including, inter alia, the heat-resistant polymer as in the present claims, or the photoreactive

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compound which generates an acid upon undergoing a reaction with light, or wherein the composition is a positive photosensitive composition, and advantages thereof.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims in the application are respectfully requested.

Applicants request any shortage or excess in fees in connection with the filing of this paper, including extension of time fees, and for which no other form of payment is offered, be charged or credited to Deposit Account No. 01-2135 (Case: 1270.43264X00).

Respectfully submitted,

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